Mareike Adler, Anna K. Koch*

Expanding the Job Demands-Resources Model to Classify Innovation-Predicting Working Conditions**

We applied the job demands-resources (JD-R) model (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001) and a new categorization approach to study the relationship between working conditions and innovation. By applying confirmatory factor analysis and structural equation modeling to a cross-sectional online study (N = 780), we showed that two types of demands, hindrance and challenge, and two types of job resources, task-related and social, represent different types of working conditions with respect to innovation. Task-related and social job resources positively predicted individual innovation. Social job resources and challenge job demands revealed a positive association with perception of organizational innovation, whereas hindrance job demands were negatively related to it. The relevance of the studied types of working conditions for individual and perceived organizational innovation varied.

Key words: **Job demands-resources model, working conditions, innovation, challenge-hindrance framework, task-related and social job resources** (JEL: J81, O30)

In times of increasing competitive constraints, organizations must remain innovative to further their competitive advantage (Crossan & Apaydin, 2010; Rubera & Kirca, 2012; Urbancova, 2013). Researchers seek to determine the factors that promote or inhibit innovation. One of the best ways to promote innovation in organizations is to provide good working conditions (Hammond, Neff, Farr, Schwall, & Zhao, 2011; Hülsheger, Anderson, & Salgado, 2009). However, research findings have varied. Certain working conditions have been identified as innovation-promoting. Other conditions have been identified as innovation-hindering or have been neglected thus far. Such divergent results may have occurred due to varying or unfit systematizations of working conditions in studying innovation. Additionally, innovation has primarily been studied at the individual level. However, innovation

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Introduction
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also occurs at the organizational level and is important for company success (West & Farr, 1990). Studies considering working conditions and innovation at the organizational level are scarce. Therefore, it is important to study both levels of innovation (Damanpour, 1991) because both forms of innovation may have different predictors.

This study pursues two main goals: first, to introduce a new categorization approach to study working conditions in the innovation context for providing clarity to mixed findings in innovation research. Second, to apply this approach in analyzing the various influences of categories of working conditions on different levels of innovation. This application provides information regarding their relevance for innovation at various levels. Furthermore, our study provides empirical research on the link between working conditions that has thus far been neglected in the area of research. The suggested systematization for working conditions may be beneficial for further innovation research and provide information to assist practitioners in fostering innovation-promoting working conditions and diminishing innovation-hindering working conditions.

Innovation in Organizations

Innovation is "the intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, the organization or wider society" (West & Farr, 1990, p. 9). As noted by West and Farr (1990), innovation can occur at both the individual and organizational levels. Creativity is considered to be an aspect of innovation (De Jong & Den Hartog, 2010; West, 2002 a). Moreover, the individuals in organizations, the employees, are considered to be parts of the organization that contribute to organizational innovation. Their perception of organizational innovation (POI) is of special interest. Studies have examined the relationships between working conditions and innovation at the individual level (Hammond et al., 2011; Martín, Salanova, & Peiró, 2007; Ohly, Sonnentag, & Pluntke, 2006; Rasulzada & Dackert, 2009). However, to the best of our knowledge, few studies have examined the relationship between working conditions and innovation at the organizational level. In recent years, this topic has been widely neglected in work and organizational psychology research (for an overview, see Crossan & Apaydin, 2010; Lam, 2004).

Linkages Between Working Conditions and Innovation

The job demands-resources (JD-R) model (Bakker & Demerouti, 2007; Demerouti et al., 2001) structures and simplifies the study of working conditions and outcomes (Bakker, Demerouti, & Verbeke, 2004; Demerouti et al., 2001; Schaufeli & Taris, 2014). The initial JD-R model states that job aspects can be classified into the following two categories: job demands and job resources (Demerouti et al., 2001).

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Job demands, such as stress and a high workload, may become burdensome when these demands exceed employees' capabilities (Bakker, Hakanen, Demerouti, & Xanthopoulou, 2007; Halbesleben, 2010). Job demands that have been considered in work and organizational contexts include illegitimate tasks and qualitative overload (Bakker et al., 2004; Semmer, Tschan, Meier, Facchin, & Jacobshagen, 2010; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2007). Job resources are defined as "[…] physical, psychological, social, or organizational aspects of the job" (Demerouti et al. 2001, p. 501) Job resources (for example, task-related conditions), such autonomy at work (Halbesleben, 2010), and social aspects, such as social support and feedback (Anderson, De Dreu, & Nijstad, 2004; Bakker & Demerouti, 2007; Bakker, Van Emmerik, & Van Riet, 2008) can support employees' attainment of job goals and personal growth (Demerouti et al., 2001).

Some studies have included innovation as a criterion within the JD-R model (Huhtala & Parzefall, 2007; Martín et al., 2007). However, the majority of studies using the JD-R model have employed organizational outcomes, such as extra- and in-role performance and mental health aspects such as burnout (Bakker et al., 2004; Demerouti et al., 2001). We contribute to the literature by more closely examining how the JD-R model can be used to predict other business variables, such as innovation (Hakanen & Roodt, 2010). We focus on the association between different categories of working conditions and innovation. This provides information regarding the relevance of different types of working conditions for innovation at different levels.

Job Demands and Innovation

Job demands have been found to be important predictors of innovation (Anderson et al., 2004; Janssen, 2000). We examined the following four potentially innovation-predicting job demands: unreasonable tasks, unnecessary tasks, time pressure and qualitative overload. According to Semmer et al. (2010), illegitimate tasks (unreasonable and unnecessary tasks) can be considered stressors in the work context. A task is perceived as illegitimate when it violates norms about what can reasonably be expected from a given person in a given context (Semmer et al., 2010). Such violation can be perceived as an offence against the professional identity and person´s self-esteem (Eatough et al., 2015). This could thwart learning and performance goal attainment (Cavanaugh, Boswell, Roehling, & Boudreau, 2000; Semmer et al., 2015), which is important for innovation. Few studies have focused on the effect of illegitimate tasks on human behavior (Björk, Bejerot, Jacobshagen, & Härenstam, 2013). Semmer et al. (2010) found a positive relationship between illegitimate tasks and counterproductive behavior toward supervisors, colleagues, and the organization. Red tape (Bozeman, 2000), a similar construct, has been considered to be a potential hindrance demand in the context of organizational outcomes (Hon, Chan, & Lu, 2013; Rodell & Judge, 2009; Walker & Brewer, 2009). Illegitimate

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tasks can also represent a hindrance demand in an innovation context. Nevertheless, the link between illegitimate tasks and innovation is unclear.

According to the JD-R model, time pressure is related to emotional exhaustion, but has also been discussed as having the potential to promote personal growth and an active problem-solving style (Lepine, Podsakoff, & Lepine, 2005), which may promote innovation. Studies have indicated that time pressure has a positive relationship with innovation and creativity (Hon et al., 2013; Ohly & Fritz, 2010; Ohly et al., 2006; Rasulzada & Dackert, 2009; Unsworth, Wall, & Carter, 2005). In a daily diary study, Binnewies and Wörnlein (2011) also found a positive relationship between time pressure and creativity. However, other studies have found no relationship between these variables (Geng, Liu, Liu, & Feng, 2014; Hsu & Fan, 2010; Martín et al., 2007). Overall, studies searching for a link between time pressure and innovation have yielded inconsistent results (Amabile et al., 2002; Baer & Oldham, 2006; Binnewies & Wörnlein, 2011; Geng et al., 2014; Hon et al., 2013; Hsu & Fan, 2010; Martín et al., 2007; Ohly & Fritz, 2010; Rasulzada & Dackert, 2009; Unsworth et al., 2005). Furthermore, in the context of the JD-R model, qualitative overload is discussed as a job demand within organizations (Bakker et al., 2004). "Qualitative overload is when individuals believe they do not have the skills or capabilities to satisfactorily perform job tasks" (Britt, Thomas, & Dawson, 2006, p. 2102; Cooper, Dewe, & O'Driscoll, 2001). Qualitative work overload may promote personal growth, motivation, and achievement (Lepine et al., 2005; Podsakoff, LePine, & LePine, 2007). This in turn could facilitate innovation.

Further differentiation within the concept of job demands. When considered together, the results obtained are inconclusive regarding the relationship between job demands and innovation. There is a need to conduct further research on the effect of job demands on innovation (Binnewies & Gromer, 2012; Widmer, Semmer, Kälin, Jacobshagen, & Meier, 2012). Due to heterogeneous findings, a new systematization may be beneficial in studying job demands and innovation. Analogous to occupational health research, we differentiate between "challenge" and "hindrance" job stressors/demands (Lepine et al., 2005; Van den Broeck, De Cuyper, & De Witte, 2010). Challenge job demands are expected to have a positive effect on organizational outcomes because they foster personal growth and achievement. Hindrance job demands, however, may constrain this growth (Crawford, LePine, & Rich, 2010; Podsakoff et al., 2007). Research has shown that this postulated categorization system works well (Lepine et al., 2005; Van den Broeck et al., 2010). Indeed, Hon et al. (2013) suggested that hindrance stress (e.g., red tape) was negatively correlated with creativity and that challenge stress (e.g., time pressure and work overload) was positively correlated with creativity. Byron, Khazanchi, and Nazarian (2010) conducted a meta-analysis demonstrating that some of the captured demands promoted creativity and that others hindered creativity. This led us to the assumption that challenge job demands may promote and that hindrance job demands could hinder innovation. A different systematization of job demands may

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uncover new evidence on the relationship between job demands and innovation at both the individual and organizational levels. Research on the link between different job demands and organizational innovation is unfinished (Hammond et al., 2011).

Hence, we postulate the following hypotheses:

H1: Job demands can be differentiated into challenge (time pressure and qualitative overload) and hindrance (unreasonable and unnecessary tasks) job demands.

H2: Hindrance job demands (unreasonable and unnecessary tasks) negatively predict a) individual innovation and b) POI.

H3: Challenge job demands (time pressure and qualitative overload) positively predict a) individual innovation and b) POI.

Job Resources and Innovation

Job resources generally have been found to be positively related to innovation (Hammond et al., 2011; Martín et al., 2007; Ohly et al., 2006; Rasulzada & Dackert, 2009) and creativity at work (De Jonge, Spoor, Sonnentag, Dormann, & Van den Tooren, 2012). Nevertheless, the set of job resources that has been studied is limited. In a work context, further job resources are relevant for innovation.

One of these neglected constructs is creative requirement. Creative requirement in work tasks is discussed as a common basis for individual and organizational innovation. It is "the perception that one is expected, or needs, to generate work-related ideas" (Unsworth et al., 2005, p. 542). That may stimulate creativity and personal development which in turn could be functional in achieving work goals and be supportive for innovation. Binnewies and Gromer (2012) conducted a longitudinal study with teachers and found a substantial positive relationship between creative requirement and the early stages of the innovation process. Research considering a creative requirement and its relation to innovation on different levels is required. Moreover, complexity has been recognized as a positive predictor of the indicators of individual innovation and creativity (Baer & Oldham, 2006; Hammond et al., 2011; Ohly et al., 2006; Shalley, Zhou, & Oldham, 2004). Task complexity is associated with complex decision-making (Wegge, Roth, Neubach, Schmidt, & Kanfer, 2008), job responsibility, and the use of various existing skills. When jobs are complex, individuals experience increased interest and excitement, which in turn could foster creative achievement (Oldham & Cummings, 1996) and innovation. Noefer, Stegmaier, Molter, and Sonntag (2009) found evidence that a high level of complex tasks correlated with a high level of idea generation and idea implementation. However, Urbach, Fay, and Goral (2010) were only able to replicate the effect of task complexity on idea implementation. Last but not least, when employees are faced with a variety of tasks, they experience more control and make more suggestions re-

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garding how their work can be improved (Axtell et al., 2000; Scott & Bruce, 1994). This in turn could promote innovation. Task variety is defined as "the extent to which an individual performs different tasks at his or her job" (Humphrey, Nahrgang, & Morgeson, 2007, p. 1335), and may activate a variety of employee skills and competencies, offering new learning opportunities and goals. Therefore, task variety may be beneficial for innovation. Montani, Odoardi, and Battistelli (2014) even found an indirect effect of task variety on individual innovation. Further research is required.

In addition to job resources that are located at the task level, job resources such as the social support of colleagues and supervisors also affect innovation and creativity at work (Anderson et al., 2004; Binnewies & Gromer, 2012; Hammond et al., 2011; Ohly et al., 2006; Prieto & Perez-Santana, 2014). Employees who receive social support are more likely to be innovative than employees without social support (Prieto & Perez-Santana, 2014). Baer and Oldham (2006) found indirect paths between social support and creativity. There appears to be consensus that social support positively predicts individual innovation at work. Therefore, social support is an important variable when studying innovation-related job resources that derive from social interaction. In JD-R model research, feedback is considered an important job resource that instigates a motivational process leading to job-related learning, in addition to role performance (Bakker & Demerouti, 2007; Bakker et al., 2008) resulting in innovation. Feedback from colleagues and supervisors or structural feedback positively predicts innovation or creativity at the individual level (Hon et al., 2013; Noefer et al., 2009). Zhou (2003) reported that developmental feedback from supervisors was indirectly related to employee creativity. Nevertheless, the relationship between job resources that result from social interaction and organizational innovation is unclear.

Taken together, these findings suggest that different job resources facilitate innovation. However, the effects of job resources on the task level (e.g., creative requirement, complexity, task variety) and resources resulting from social interactions have not yet been studied with respect to organizational innovation. Antonioli, Mazzanti, and Pini (2009) provided the first evidence of positive correlations between working conditions (e.g., autonomy) and innovation at the organizational level. Zhang and Li (2009) reported evidence that human resource management practices (e.g., employee participation) were positively related to firm innovation. Crespell and Hansen (2008) showed that a climate that fostered innovation, including high levels of autonomy, support and resources, affected innovation at the organizational level. Additionally, the presence of a learning culture that contains aspects of working conditions, such as feedback, has been shown to positively affect firm innovation (Farooq, 2012).

Further differentiation within the concept of job resources. In addition to the distinction between hindrance and challenge job demands, evidence suggests that job

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resources may also be categorized into different types of resources. Unlike the concept of job demands, to the best of our knowledge very few studies have examined the possibility of making further distinctions within the concept of job resources within the JD-R model.

Demerouti et al. (2001, p. 501) shows that job resources may be distinguished by different categories: "Job resources refer to […] physical, psychological, social, or organizational aspects of the job". Bakker, Demerouti, De Boer, and Schaufeli (2003, p. 345) extended the original definition of job resources by considering the findings from Hackman and Oldham (1976), noting, "resources may be located at the level of the organization at large (e.g., pay, career opportunities, job security), at the interpersonal level (e.g., supervisor and co-worker support, team climate), at the level of the organization of work (e.g., role clarity, participation in decision-making), and at the task level (e.g., performance feedback, skill variety, task significance, task identity, autonomy". In the context of workplace health promotion, a differentiation between organizational and social resources has been discussed (Udris, Kraft, Mussmann, & Rimann, 1992; Udris, 2006). Llorens, Schaufeli, Bakker, and Salanova (2007) used the terminology "task resources" in their paper but did not identify other resource categories and therefore could not test whether distinct resource categories had different effects. One of the few studies to empirically differentiate between the different types of resources examined social job resources (social support, coaching and feedback) and structural resources (autonomy, opportunities for development and variety) more closely (Tims, Bakker, & Derks, 2013). These authors showed that both types of resources influenced work engagement, burnout, and job satisfaction but that structural resources had a stronger impact on these outcomes than social job resources.

Based on our theoretical considerations and on empirical evidence found by Tims et al. (2013), we categorized the job resources examined in our study into "task-related job resources" and "social job resources." Social job resources refer to those aspects of working that involve interaction with other humans, such as social support or feedback. Task-related job resources involve those working conditions that refer directly to the task or the work itself, such as complexity or task variety. Thus, we postulate the following hypotheses:

H4: Job resources can be differentiated into task-related (creative requirement, complexity and task variety) and social job resources (social support and feedback).

H5: Task-related job resources (creative requirement, complexity and task variety) positively predict a) individual innovation and b) POI.

H6: Social job resources (social support and feedback) positively predict a) individual innovation and b) POI.

Figure 1 illustrates the hypotheses of this study.

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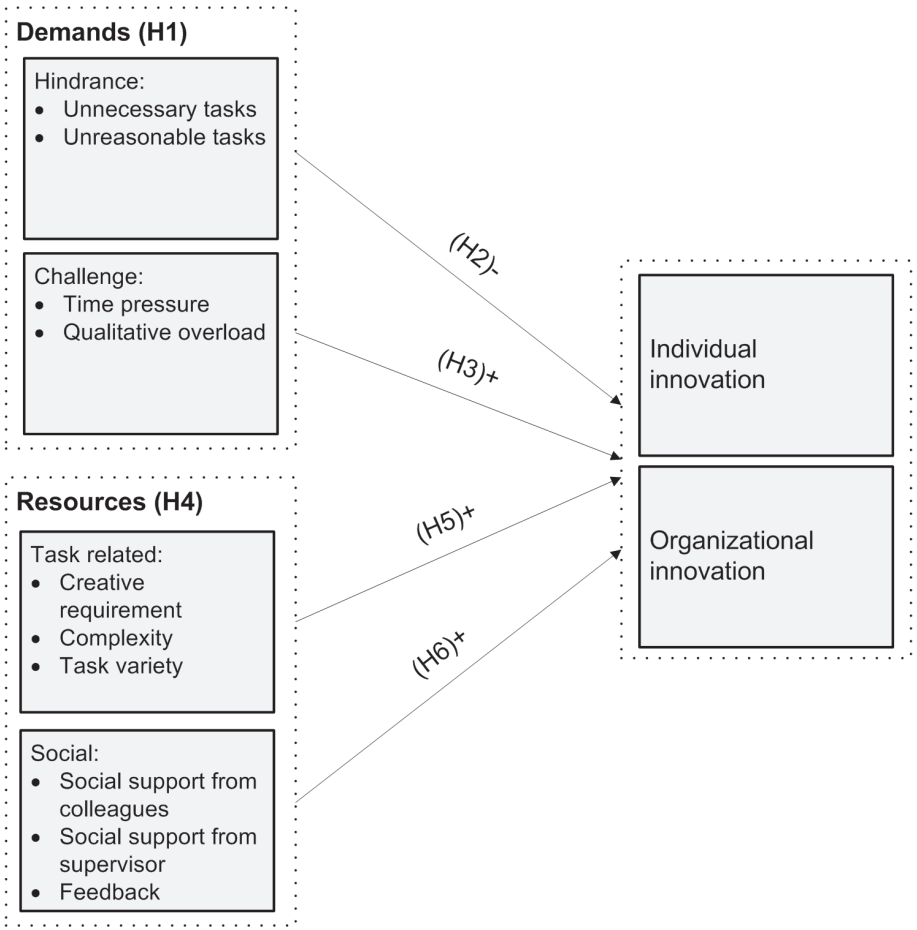

Figure 1. **Research model**

Method

Participants and Procedures

We collected data in the context of the project "Innovation capacity within demographic change" via an online survey. The participants included 807 German employees of different companies. Due to systematically missing values and implausible time duration for completing the questionnaire ("speeders"), 27 people were excluded from further calculations. The final sample included 780 workers, of whom 424 were female (54.3 %) and 357 were male (45.7 %). The average age was 42.95 years (*SD* = 11.50), and the average hours worked per week were 37.33 (*SD* = 10.11). The companies involved differed in size as follows: 150 participants worked

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in companies with fewer than 20 employees (19.2 %), 102 worked in companies with between 21 and 50 employees (13.1 %), 174 worked in companies with between 51 and 250 workers (22.3 %), 83 worked in companies with between 251 and 500 (10.6 %) workers, and 272 worked in companies with more than 500 employees (34.8 %). Regarding the highest educational background achieved, 23 participants were untrained (2.9 %), 474 had completed vocational training (60.7 %), 265 had attained a university education (33.9 %), and 11 had earned a PhD (1.4 %). Eight participants did not provide information about their education (1.0 %). The industries in which the participants worked differed distinctly. Data were collected on a single occasion by a panel data institute, which provided a heterogeneous sample from various industries (e.g., information technology, media and advertising) and guarantees data quality according to recent ESOMAR standards.

Measures

Job demands

Illegitimate tasks. The Bern Illegitimate Tasks Scale (BITS; Semmer, Jacobshagen, & Meier, 2006; Semmer et al., 2010) measures two aspects: *unreasonable tasks* and *unnecessary tasks*. Each scale includes four items. Example questions include, "Do you have work tasks to complete that make you wonder whether they have to be done at all?" for unnecessary tasks and "Do you have work tasks to complete that you believe are going too far and should not be expected from you?" for unreasonable tasks. The responses were recorded on a five-point scale (1 = *never*, 5 = *frequently*).

Qualitative overload. Qualitative overload was measured using a three-item scale termed the Salutogenetic Subjective Work Analysis (SALSA) from Rimann and Udris (1997) on a five-point scale (1 = *almost never,* 5 = *almost ever*). For example, one item states, "You are given work that is too hard to complete."

Time pressure. Time pressure was assessed using the German version of the Copenhagen Psychosocial Questionnaire (COPSOQ; Nübling, Stößel, Hasselhorn, Michaelis, & Hofmann, 2005) with four items. For example, one question asks, "Do you have to work very fast?" The responses were measured on a five-point scale (1 = *never*, 5 = *always*).

Job resources

Creative requirement. The construct creative requirement was measured using a modified version of the creative requirement measure (Unsworth et al., 2005). The five items with best item selectivity were translated into German via forward and back translation techniques (International Test Commission, 2005). One item states, "My job requires me to have ideas about work procedures." Answers were

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recorded on a five-point scale (1 = *to a very small amount,* 5 = *to a very high amount*).

Complexity. The complexity of work tasks was assessed with six items from a well-validated German scale (Semmer, Zapf, & Dunckel, 1999; Zapf, 1993) adapted from Grimme (2012). For example, participants were asked, "Does your work require extensive knowledge and skills?" (1 = *never*, 5 = *always*).

Task variety. The variability of work tasks was measured using four items of the Work Design Questionnaire (WDQ; Morgeson & Humphrey, 2006; Stegmann et al., 2010) on a five-point scale (1 = *I don't agree at all,* 5 = *I totally agree*). One item stated, "The job requires the performance of a wide range of tasks."

Social support. Social support from colleagues and supervisors was measured using six items of the social support scale from Rimann and Udris (1997). Example questions included, "How much can you rely on your colleagues when it gets difficult at work?" and "How much can you rely on your supervisor when it gets difficult at work?" (1 = *not at all*, 5 = *totally*).

Feedback. Work-related feedback was assessed using three items in the WDQ (Stegmann et al., 2010). One example stated, "I receive a great deal of information from my manager and co-workers about my job performance." Answers were recorded on a five-point scale (1 = *I don't agree at all*, 5 = *I totally agree*).

Indicators of innovation

Individual innovation. Innovative work behavior at the individual level was measured using a nine-item scale from Janssen (2000) and Scott and Bruce (1994), which was translated into German by Hardt (2011). This scale consists of the following three innovation factors: idea generation, idea promotion and idea realization. A second-order factor was used for the analysis because first-order factors are strongly correlated. An example item stated, "Please indicate how often you create new ideas for difficult issues" (1 = *never*, 5 = *always*).

POI. Innovation was quantified at the organizational level using the firm innovativeness scale from Calantone, Cavusgil, and Zhao (2002). The scale originally contained six items (e.g., "Our company frequently tries out new ideas"; 1 = *not at all*, 5 = *totally*) and was translated into German by the authors (International Test Commission, 2005). Because one of the items exhibited poor reliability, we included only five of the items in the analyses.

Control variables

As control variables, we included sex, age, working hours, and education. Because of missing values in the industries variable, we were not able to control for this variable.

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Statistical Analysis Strategy

We used the statistical software R (The R Core Team, 2013). For confirmatory factor analysis (CFA) and structural equation modeling (SEM) analyses, we used the Lavaan package from Rosseel (2012). A covariance data matrix and the robust maximum likelihood estimator (MLM) with robust standard errors and a Satorra-Bentler scaled test statistic were used for parameter estimation (Rosseel, 2015; Satorra & Bentler, 1994). In our study, we refer to standardized estimates.

The fit of the model to the data was assessed using the Satorra-Bentler scaled chi-square value (χ^2) (Satorra & Bentler, 1994), the comparative fit index (CFI), the root mean square error of approximation (RMSEA) and the standardized root mean residual (SRMR). As an additional criterion for comparing the models, we consulted a chi-square difference test ($\Delta\chi^2$) (Colwell, 2012; Kline, 2005; Satorra & Bentler, 2001; Walker, 2015) and the Akaike information criterion (AIC). A non-significant chi-square indicates good model fit (Hoyle, 2012). However, the value of chi-square is sensitive to sample size (Barrett, 2007; Hoyle, 2012). Barrett (2007) noted that "in general, the larger the sample size, the more likely a model will fail to fit via using the χ^2 goodness of fit test." Thus, it is not appropriate to use this parameter as the sole criterion for rejecting a model. Schermelleh-Engel, Moosbrugger, and Müller (2003) recommended the use of additional goodness-of-fit measures when interpreting model fit. In general, models with fit indices > .90 and RMSEA < .06 and SRMR < .08 indicate an acceptable to good fit between the models and the data (Hu & Bentler, 1999; Little, 2013). Hoyle (2012) recommended the use of the CFI as an efficient fit index that is not affected by sample size. Regarding the AIC, the model with the lowest AIC is preferred (Burnham & Anderson, 2004; Hoyle, 2012). AIC performs well when using large sample sizes (Hoyle, 2012).

Results

Descriptive Statistics and Correlations

Table 1 contains the descriptive statistics of the measured scales, the number of items per scale, the internal consistency (Cronbach's α) of all of the measured scales, and correlations.

The results revealed the reasonable to very good reliability of the assessed scales (Dunn, 2004; Everitt & Skrondal, 2010). All the working conditions were correlated with the indicators of innovation. The variables working hours per week, sex, and education were correlated with working conditions and with individual innovation and POI. Carlson and Wu (2012) recommend a thrifty use of control variables. Therefore, in the following SEM analyses, we treated these variables (working hours per week, sex, and education) as control variables. The observed variables were different working conditions and individual innovation and POI. We used these observed variables as the indicators of the first-order latent factors (i.e., the

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Table 1
Descriptive Statistics, Number of Items, Internal Consistency of all Measured Scales, and Correlations

	Scale	No. items	*M*	*SD*	α	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	Creative requirement	5	2.52	1.00	.90															
2.	Complexity	6	3.38	0.84	.87	.57***														
3.	Task variety	4	3.70	0.88	.89	.40***	.56***													
4.	Feedback	3	2.99	0.91	.73	.28***	.24***	.26***												
5.	Social support: Supervisor	3	3.48	1.07	.92	.11**	.14***	.23***	.53***											
6.	Social support: Colleagues	3	3.72	0.88	.89	.02	.03	.14***	.45***	.48***										
7.	Time pressure	4	3.06	0.76	.79	.28***	.32***	.17***	-.04	-.27***	-.24***									
8.	Qualitative overload	3	2.30	0.88	.85	.26***	.21***	.10**	-.07	-.28***	-.19***	.48***								
9.	Unnecessary tasks	4	2.66	0.98	.91	.14***	.05	-.06	-.21***	-.41***	-.23***	.36***	.50***							
10.	Unreasonable tasks	4	2.29	0.88	.89	.19***	.13***	.01	-.13***	-.40***	-.30***	.50***	.62***	.67***						
11.	Individual innovation	9	2.74	0.77	.95	.55***	.44***	.30***	.35***	.21***	.10**	.19***	.11**	-.01	.06					
12.	Organizational innovation	5	2.77	0.84	.89	.32***	.27***	.23***	.33***	.35***	.23***	.09*	.04	-.15***	-.10**	.45***				
13.	Working hours	1	37.14	8.71	-	.22***	.29***	.19***	.08*	-.01	-.01	.21***	.13***	.11**	.14***	.16***	.09*			
14.	Sex[a]	1	-	-	-	.03	.10**	.04	.05	.06	.03	-.03	.05	-.02	-.03	.08*	.07	.32***		
15.	Age	1	42.92	11.48	-	-.05	.06	.12***	.06	.00	.02	-.09*	-.06	-.11**	-.14***	.03	-.02	.00	.19***	
16.	Education	1	2.96	1.31	-	.21***	.25***	.10**	.12***	.03	.02	.09**	.07	.02	.07*	.16***	.10**	.16***	.11**	.06

Note. $N = 780$; M = mean; SD = standard deviation; α = Cronbach's alpha.
[a]Sex: 1 = female, 2 = male.
* $p < .05$, ** $p < .01$, *** $p < .001$.

specific working conditions, POI, and the facets of individual innovation). The specific working conditions served as indicators of our postulated second-order latent factors (i.e., challenge job demands, hindrance job demands, task-related job resources, and social job resources). Our analyses revealed that the results were not affected by multicollinearity.

Consistent with Byrne (2001), all the factor loadings followed the theoretically assumed direction. Following the rules established by Hair, Black, Babin, and Anderson (2010), all the items had significant loadings on the intended latent variable, and all the first-order latent factors had significant loadings on the intended second-order latent factors.

Differentiation Within the Job Demands and Job Resources Categories: Results of CFA

Table 2 depicts the results of CFA of the different categorizations of working conditions as being related to individual innovation and POI. First, we compared a model with one job demand and one job resources factor (M1) with a model with two job demand factors (challenge/hindrance) and one job resources factor (M2). We also compared a model including two types (task-related/social) of job resources and one job demand factor (M3) with these models. Finally, we tested a model including challenge and hindrance job demands and task-related and social job resources (M4) against the other models. In all the models, individual innovation and POI were included in the analysis.

The value of χ^2 was significant for all of the models (Table 2). The fit indices of M1 and M2 were similar. However, the Satorra-Bentler scaled χ^2 difference test (Colwell, 2012; Walker, 2015) revealed that M1 fit the data significantly worse than M2 ($\chi^2_{\text{diff}} = 77.67$, $\Delta df = 4$, $p < .001$). The AIC confirmed that M2 fit the data better than M1. In sum, the model that considered two types of job demands and one resources factor fit the data slightly better than the model with only one type of job demand and one resources factor. Therefore, *H1* was confirmed.

Regarding the differentiation of job resources, the results indicated that M1 fit the data worse than M3 ($\chi^2_{\text{diff}} = 845.92$, $\Delta df = 4$, $p < .001$). CFI, RMSEA and SRMR revealed M3 with two job resources factors (task-related/social) to better fit to the data than M1. The AIC of model M3 was lower than that of M1. Thus, *H4* was confirmed.

Finally, comparing the model including two types of job demands and two types of job resources (M4) with M1 ($\chi^2_{\text{diff}} = 791.55$, $\Delta df = 9$, $p < .001$) and M3 ($\chi^2_{\text{diff}} = 83.64$, $\Delta df = 5$, $p < .001$), our analysis revealed that the model differentiating between challenge and hindrance job demands and task-related and social job resources fit the data best. A model treating job complexity as a challenge demand as

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Table 2

Working Conditions, Individual Innovation, and POI: The Results of CFA

	Model	χ^2	*df*	*p*	CFI	RMSEA	RMSEA CI	p CI RMSEA (90%)	SRMR	AIC
M1	Job demands and job resources	3,842.32	1306	.000	.90	.05	.048 – .052	.54	.11	93,973.41
M2	Challenge and hindrance demands, job resources	3,764.65	1302	.000	.90	.05	.048 – .051	.77	.10	93,891.77
M3	Job demands, task-related and social job resources	3,229.38	1302	.000	.92	.04	.042 – .045	1.00	.07	93,268.25
M4	Challenge and hindrance demands, task-related and social job resources	3,145.74	1297	.000	.92	.04	.041 - .045	1.00	.06	93,180.94

Note. χ^2 = Satorra-Bentler scaled chi-square; *df* = degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean residual; CI = confidence interval; AIC = Akaike information criterion; *N* = 780

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well as a model considering qualitative overload as a hindrance demand revealed a worse fit to the data than our final model.

Relationships Between Working Conditions and Innovation

To analyze the relationship between challenge and hindrance job demands and task-related and social job resources with individual innovation and employee POI, we conducted SEM analyses on the basis of model M4. The SEM revealed a good fit to the data (χ^2 = 3,322.07, *df* = 1444, $p < .001$; CFI = .92; RMSEA = .04, RMSEA CI = .040 - .044, p CI RMSEA 90 % = 1.00; SRMR = .06) (Burnham & Anderson, 2004; Hu & Bentler, 1999; Little, 2013; West, Taylor, & Wu, 2012). Explained variance in individual innovation was 41.2 %, and in POI 36.7 %. Figure 2 illustrates the results of the significant path coefficients (γ) in the structural equation model.

The structural equation analysis (Figure 2) revealed that the coefficient of the path from hindrance job demands to individual innovation was close to zero and not significant (γ = .02, *ns*). We found a similar pattern for the relationship between challenge job demands and individual innovation: the path coefficient from challenge job demands to individual innovation was zero and also not significant (γ = . 02, *ns*). Thus, neither hypothesis, *H2 a* nor *H3 a*, was confirmed.

According to hypotheses *H5 a* and *H6 a*, our results indicated positive and highly significant relationships between task-related job resources (γ = .57, $p < .001$) and social job resources (γ = .17, $p = .002$) with individual innovation (Figure 2). Thus, both types of job resources were positively related to individual innovation, and hypotheses *H5 a* and *H6 a* were confirmed.

To elucidate the relationship between working conditions and perceived innovation at the organizational level, we conducted SEM analyses with all of the factors of working conditions and POI (Figure 2). The results obtained indicate that a negative and significant association exists between hindrance job demands and employee POI (γ = -.63, $p < .05$). The path coefficient of challenge job demands on POI was positive and significant (γ = .81, $p < .01$). Thus, *H2 b* and *H3 b* were confirmed.

Our analyses reveal no association between task-related job resources and employee POI (γ = .02, *ns*), whereas social job resources revealed a significant relationship with POI (γ = .44, $p < .001$). Thus, *H5 b* could not be confirmed, but *H6 b* was confirmed.

Discussion

Although the majority of researchers and managers would agree that innovations are an important factor in an organization's success, research on the relationship between the various types of working conditions and innovation on both the individual and organizational level has been scarce and has produced mixed findings (Bin-

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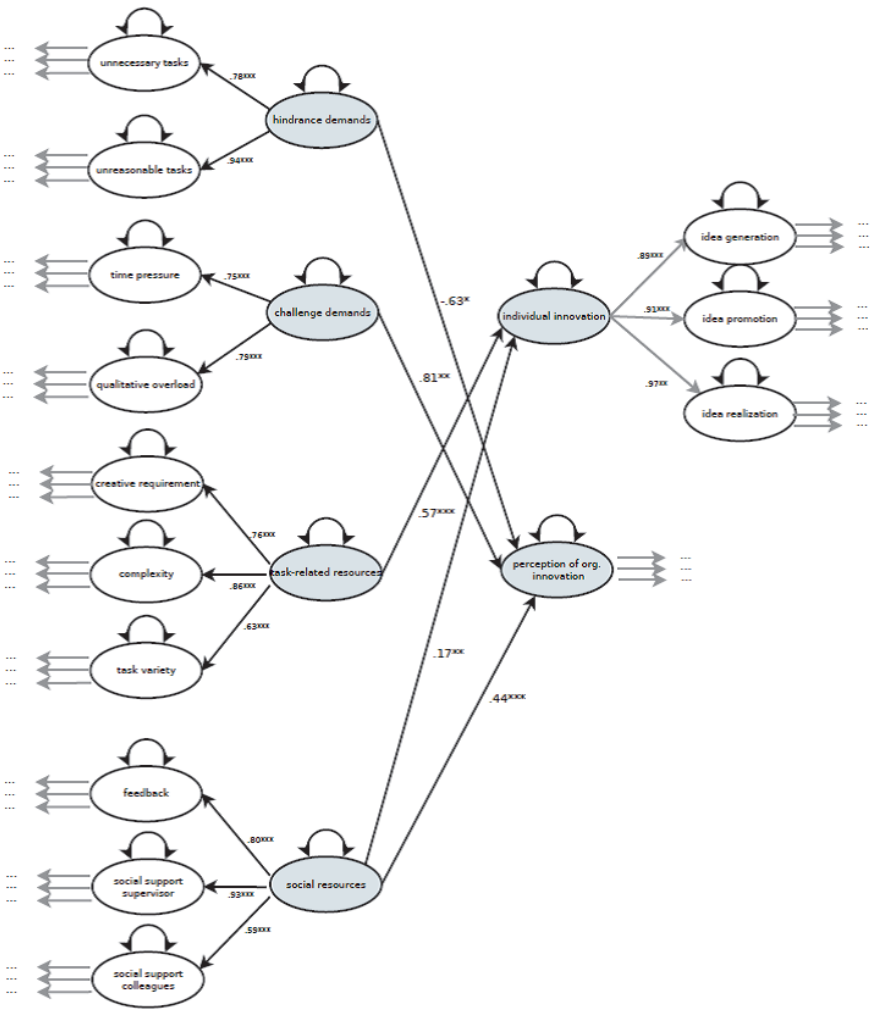

Figure 2. **Challenge and hindrance job demands, task-related and social job resources and their relationship with individual innovation and POI.**

N = 780; we controlled for working hours, sex and education; significant path coefficients are depicted.
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

newies & Gromer, 2012; Byron et al., 2010; De Jonge et al., 2012; Lam, 2004; Widmer et al., 2012). We suggest that the main reasons for these mixed findings are the heterogeneous systematization of working conditions, a neglect of certain inno-

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vation-relevant working conditions and the lack of studies examining the different levels of innovation.

To address this topic, we demonstrated that, based on JD-R model, working conditions can be categorized into different types in the context of innovation. Using CFA, we confirmed the classification of job demands into two categories, namely, hindrance and challenge job demands. Our results also revealed that job resources can be differentiated into social and task-related job resources. Although the differences between the models were slight, the four-fold factor solution fit the data significantly better than the other solutions. Our results provided evidence that the JD-R model, when combined with the differentiation of working conditions into challenge and hindrance job demands and task-related and social job resources, may be useful for studying innovation in organizations. These findings were consistent with the results obtained in other research areas (e.g., leadership research) (Lepine et al., 2005; Llorens et al., 2007; Tims et al., 2013; Udris, 2006; Van den Broeck et al., 2010; Vincent, 2012). Distinguishing between task-related and social job resources enables a more detailed consideration of the effect of job resources on innovation. Additionally, with the aid of this differentiation, it is possible to study differences in the relevance of task-related and social job resources to innovation and further outcomes.

Based on these results, we analyzed the direction and strength of the relationship of the four categories of working conditions with individual innovation and employee POI. Our results showed that neither hindrance job demands nor challenge job demands were related to individual innovation. This finding may be related to the fact "that job demands may relate differently to specific outcome variables" (Schaufeli & Taris, 2014, p. 52) on different levels of analysis. Analogous to results from research in the context of the JD-R model and occupational health, job demands could be relevant predictors of negative indicators but less relevant for positive indicators on the individual level (Boyd et al., 2011; Luchman & González-Morales, 2013). Moreover, innovation has most often been studied as an entire construct (Hammond et al., 2011). However, innovation consists of several steps, which allows studying the topic in more detail (Hammond et al., 2011; West, 2002 b). Job demands could be relevant during the early stages of individual innovation instead of the entire innovation process. For example, employee creativity as an important factor during idea generation (De Jong & Den Hartog, 2010; Janssen, 2000; West, 2002 a) has been found to be related to hindrance and challenge job demands (Hon et al., 2013).

With respect to POI, hindrance job demands were negatively associated with it (γ = -.63, $p < .05$). These results are in line with our hypothesis and suggest that a high level of hindrance job demands may exceed employees' capabilities and therefore diminish their achievement, goal attainment and innovation in the workplace (Boswell, Olson-Buchanan, & LePine, 2004; Cavanaugh et al., 2000; Crawford et

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al., 2010). In line with our hypothesis, challenge job demands were positively associated with POI ($\gamma = .81$, $p < .01$). This result underlines the assumption that these demands promote mastery, personal growth, and future gains (Cavanaugh et al., 2000; Crawford et al., 2010), which in turn could positively affect organizational outcomes, such as innovation.

Regarding task-related and social job resources, we found a positive relationship with individual innovation. In the literature, job resources have been described as promoting personal growth and development in the workplace and are effective in achieving work goals (Bakker et al., 2003, 2004; Demerouti et al., 2001). Additionally, the positive effects of job resources on innovation have been reported in previous studies and meta-analyses (Hakanen, Perhoniemi, & Toppinen-Tanner, 2008; Hammond et al., 2011; Martín et al., 2007; Ohly et al., 2006; Rasulzada & Dackert, 2009). Regarding the strength of the effects, the relationship between individual innovation and task-related job resources was more strongly related ($\gamma = .57$, $p < .001$) than social job resources to individual innovation ($\gamma = .17$, $p < .01$). Job resources at the task level may be more important for individual innovation than social aspects, such as feedback and social support from colleagues and supervisors. Tims et al. (2013) also found evidence that structural resources had a stronger impact on business-related outcomes (e.g., job satisfaction) than social job resources. Employees are directly concerned with their task-related job resources. The same person who is confronted with unique working conditions will potentially exhibit innovative behavior. Thus, interactions with other people may be less important than task-related job resources with regard to exhibiting individual innovation (Hammond et al., 2011).

Notably, social job resources ($\gamma = .44$, $p < .001$) were related to POI, whereas, contrary to our hypothesis, no association was found between task-related job resources and employee POI. Interaction between individuals may be a more important source of innovation at the group level than the single individuals themselves (Paulus, 2000). Therefore, task-related job resources that are unique to single individuals may not facilitate POI as social job resources do.

In summary, the combination of a high level of task-related and social job resources appears to be beneficial for promoting individual innovation. Here, task-related job resources seem to be more important than social job resources. Surprisingly, job demands were not related to individual innovation. Regarding employee POI, a high level of social job resources and challenge job demands and low hindrance job demands appeared to be advantageous for POI. Social job resources appear to be more important for POI than for individual innovation.

Strengths and Limitations

Our study possesses several strengths. First, we included an array of ten different working conditions. Second, we measured innovation not only at the individual

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level but also at the perceived organizational level. Third, in our statistical analysis, we conducted SEM, which considers the use of a measurement model and provides robust standard errors and corrected test statistics. Our final sample consisted of 780 employees; thus, our analyses were conducted on a large sample. We captured a heterogeneous sample that enables a larger variance explanation and more reliable estimated relationships than homogenous samples. Nevertheless, studies with heterogeneous samples may be faced with more variables that affect the outcome variable than studies with a homogenous sample. Finally, building on work by Tims et al. (2013), our study empirically tested and supplied theoretical arguments for a further differentiation of working conditions within the JD-R model and transferred it to the innovation context.

In addition to its strengths, our study also has limitations. We assessed employees' perception of the innovation of their organization rather than using an objective measure for organizational innovation. Therefore, this variable is based on subjective interpretations instead of on absolute numbers. According to the definition, innovation must "significantly benefit the individual, the group, the organization (…)" (West et al., 1990, p. 9). Therefore, employees may be able to perceive and evaluate organizational innovation. Additionally, the measurement of individual innovation is complex and may be problematic. As Scott and Bruce (1994, p. 603) state, "studying individual innovative behavior in a natural work context is a complex and difficult task because the criterion is often difficult to validate, and researchers are often limited to the use of perceptual measures." Additionally, the sample consisted of Germans who were interested in participating in the study and who had access to a computer. These participants are not representative of the entire labor force. Thus, our results are not completely generalizable. Due to the cross-sectional design used, the results should be interpreted with caution. Because the direction of the effects was assumed and could not be tested, reverse causation may have occurred. Future studies should attempt to address the abovementioned limitations.

Implications for Future Research

Researchers should investigate whether our results and categorization system can be replicated for other working conditions and within a longitudinal study design. It would also be valuable to examine whether our findings can be replicated in settings other than the German workforce.

Furthermore, it may be useful to consider more distinct definitions of innovation. According to West (2002 b), innovation consists of several steps. We did not analyze these steps separately because the three subscales idea generation, idea promotion, and idea realization were highly intercorrelated. Certain working conditions (e.g., time pressure) may affect one process (e.g., idea generation) but be detrimental for another innovation step (Binnewies & Gromer, 2012). Thus, future research should examine the various steps of the innovation process in greater detail (Hammond et

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al., 2011). In addition to these definition and measurement issues for the innovation construct, our results also have implications for the JD-R framework. First, although there is evidence that working conditions are important for innovation, little is known about the underlying mechanisms that influence this relationship. Schaufeli and Taris (2014, p. 55) state "…summarizing, the JD-R model specifies what kind of job and personal characteristics lead to what kind of psychological states and outcomes but does not tell us why this would be so". Research should evaluate possible moderators and mediators within this connection (Hammond et al., 2011; Schaufeli & Taris, 2014). In particular, the relationship between challenge and hindrance job demands and individual innovation requires special attention. Job demands and job resources may interact in predicting different organizational outcomes (for an overview, see Bakker and Demerouti, 2007). This interaction may also occur between challenge and hindrance job demands. To the best of our knowledge, no study has addressed this topic thus far. Second, the category of personal resources has been introduced into the JD-R model (Hakanen & Lindbohm, 2008; Hakanen & Roodt, 2010; Langelaan, Bakker, Van Doornen, & Schaufeli, 2006; Xanthopoulou et al., 2007). Personal resources may mediate or moderate the relationship between working conditions and innovation. A recent review by Schaufeli and Taris (2014) also suggests the need for additional research on personal resources. Third, several researchers have chosen to control for negative affect to elucidate the positive effects of challenge job demands (Lepine et al., 2005; Podsakoff et al., 2007; Webster, Beehr, & Love, 2011). Future research should investigate whether the effects of challenge job demands on relevant business outcomes become even stronger when negative strain is controlled for. Fourth, Schaufeli and Taris (2014) suggested that job demands and job resources may require redefinition. According to these authors, the categorization system should be based on the value of each working condition. A resource may serve as a demand as soon as it is appraised negatively (i.e., autonomy may serve as a demand when an employee does not feel able to handle the associated responsibility).

Additionally, the effect of challenge demands could be diametric, promoting business outcomes (e.g., innovation) and thereby hindering other relevant outcomes (Schmidt & Diestel, 2013; Syrek, Apostel, & Antoni, 2013). Future studies should test this assumption. It would contribute to the literature to apply the JD-R model to higher aggregation levels, such as exploring team effects, particularly concerning business-relevant outcomes for which collaboration is critical to success (Schaufeli & Taris, 2014). Moreover, innovation in the present study is defined as "the intentional introduction (…) of ideas, processes, products or procedures, new to the relevant unit of adoption (…)" (West & Farr, 1990, p. 9). These introductions in turn could evoke changes in the "how" and "what" of employees' work tasks and therefore influence working conditions. Continuative research should consider these potential reciprocal effects between working conditions and individual innovation. Our study concentrated on the classification of different types of working condi-

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tions that are relevant for innovation on different levels rather than the direction of effects. Finally, future research should test for methodological issues, such as potential suppression effects (Maassen & Bakker, 2001; MacKinnon, Krull, & Lockwood, 2000) method variance processes via marker variables (Williams, Hartman, & Cavazotte, 2010). There is also a discussion about possible non-linear relationships between some working conditions and aspects of innovation (Baer & Oldham, 2006). Future research may seize that discussion by testing for non-linear effects.

Practical Implications

To support innovation in organizations and remain competitive, organizations should remember that working conditions play an important role. Therefore, managers should attempt to foster task-related and social job resources to support individual innovation in their work team. With respect to POI, social job resources should be strengthened, whereas hindrance job demands should be kept to a minimum. Challenge demands also seem to be beneficial for POI, and therefore managers could also foster them. However, one must keep in mind that challenge job demands may be detrimental for other criteria (e.g., mental health), and therefore, they should be fostered with caution.

This paper identified innovation-relevant working conditions. Each of these working conditions can be promoted using different approaches, primarily work design. Creative requirement, for example, can be emphasized by noting its importance in job descriptions or by integrating the importance of creativity in the job itself. This goal could be achieved using performance appraisals, training or organizational symbols, such as screensavers (Unsworth et al., 2005). Task variety can be promoted by job enlargement, whereas task complexity can be promoted by job enrichment (Belias & Sklikas, 2013). To encourage social support, team building and other techniques can be useful (Hoegl & Gemuenden, 2001). Furthermore, supervisors should be aware of their function as role models and should praise and encourage appropriate behavior (Perry-Smith & Shalley, 2003). Because constructive feedback can be learned, supervisors and employees should be encouraged to provide feedback (De Stobbeleir, Ashford, & Buyens, 2011). Unnecessary und unreasonable tasks can be eliminated through process optimization and reorganization (Semmer et al., 2013). It is also important that supervisors recognize the existence of these tasks and show employees that they are taken seriously (Semmer et al., 2013).

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